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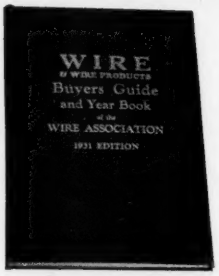

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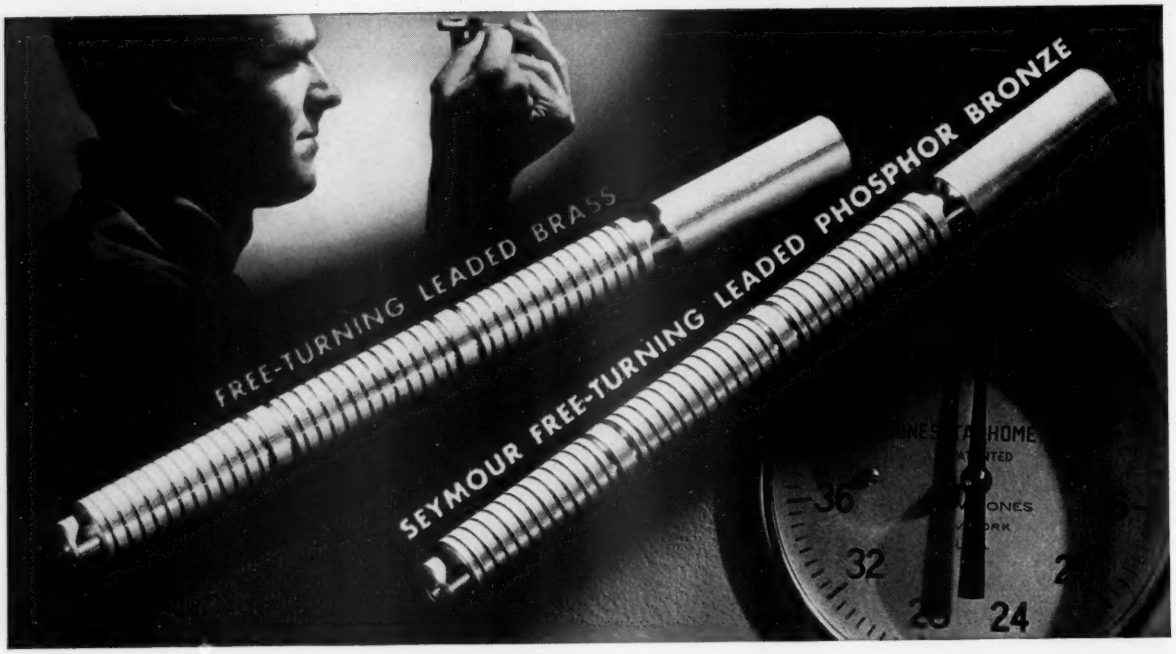

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Contents

Progress in the Annealing of Wire ..... By O. S. Haskell 37

A Continuation of a Study on Copper Wire Annealing Published in June, 1932. This Article Describes a New Furnace Development for Annealing.

Special Bronze for Telephone and Telegraph Conductors ..... By Samuel J. Rosch 40

Part III. Wire Drawing, Dies and Lubricants.

Industry in War ..... By Captain Chas. T. McAleer 43

This Paper Presents a Study of Industry and the Conditions which it Faces in the Event of a National Emergency. The Ideas Advanced are the Personal Expression of the Author and are not in Any Way Official.

What is Toncan Wire? 59

'Round the World With the Wire Industry 51

A Review of Recent Wire Patents 54

Exports and Imports of Wire 55

Buyers' Guide 63-64

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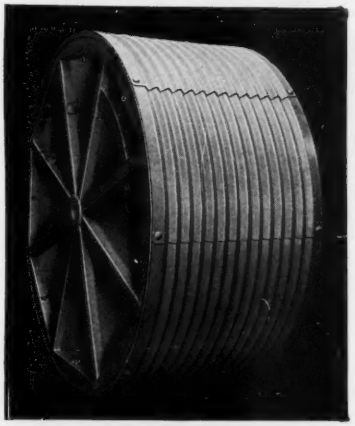

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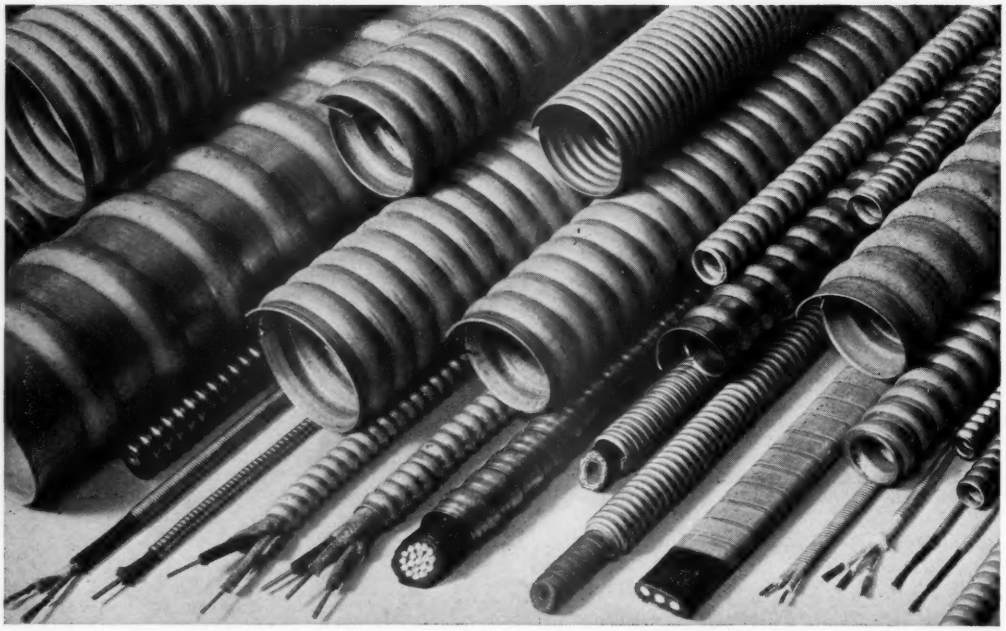

AN IDEA of the tremendous range of wire sizes and shapes in which Sleeper & Hartley Armoring Machines operate may be gleaned from the cut above. Starting with the small single circuit automobile wires, less than ⅛" in diameter, up through the standard double and triple wire "BX", these machines armor wire, hose, cable or rope in many diameters and shapes. In the background will be seen hollow conduit also made on our machines in large diameters.

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 8 FEBRUARY, 1933 No. 2

Progress in the Annealing of Wire

By O. S. Haskell

Industrial Heating Engineering Dept.
General Electric Company

THIS article describes the development of a new furnace equipment for the annealing of wire. It may be considered a continuation of my article

"Fundamentals of Copper Wire Annealing"

which was published in the June, 1931 issue of this magazine. In that article was shown the method by which the furnace equipment which seemed best suited for the needs of a large wire drawing plant was chosen.

SINCE the article published in June, 1931, was written, the **General Electric Co.** has taken a step forward and developed a general utility furnace suitable for the annealing of all sizes of copper wire. The equipment has been applied to the annealing of steel wire, copper tubing and other materials of a similar nature.

✦ ✦ ✦

WITH the growth of the electrical industry has grown the need for a better quality of wire, so in developing this equipment the prime consideration was the quality of the finished product. The annealing of wire to the modern manufacturer means a process which will deliver a clean product, requiring no pickling or wiping; also a product which, if annealed on spools or reels, will require no rewinding. The softness of the finished wire as well as the grain size must be controllable.

✦ ✦ ✦

UNTIL recently, it has been the practice of copper mills to use two types of furnaces for their finish anneal. One popular type furnace is the water sealed furnace of the elevator type. This is used for the annealing of large sizes of wire in coils or on large reels. For smaller sizes of wire on spools the retort type of furnace with a controlled atmosphere is used in the same factories, as the requirement in this case is for a dry anneal at low temperatures with a close control of the temperature cycle to eliminate stickiness of the wire. These two types of furnaces were described in my previous article.

✦ ✦ ✦

THE annealing equipment shown in figure 1 has operated so successfully that a brief repetition of the method of operation is worth while. This furnace equipment handles a load of wire with a net weight of approximately one ton. The economy of the furnace is high, averaging between 21 and 25 pounds per kwh including the power required for heating up the furnace after each week-end.

✦ ✦ ✦

Low Uniform Annealing of Copper Wire

THIS furnace was designed for a slow uniform anneal at a low temperature with a prolonged cooling cycle in order to deliver very small sizes of wire without any stickiness which would require rewinding. The heating cycle is 4½ hours and the cooling cycle 18 hours, but using one furnace and four retorts the operation is continuous and the output of one furnace is about 10,000 pounds per day. Any size of copper wire can of course be annealed in the retorts but it was specially designed for copper wire under 10 mils in diameter. It does excellent work and makes a fine production unit for those factories in which it can meet the production requirements. If one furnace does not have the capacity, multiple furnaces may be advisable as the equipment does not require much floor space.

✦ ✦ ✦

THE operation is simple. The work is loaded into the retorts and the covers are bolted on gas

tight. As the pressure is maintained at all times on the inside of the retort slight leaks will not cause the damage which might occur using the vacuum system as any leakage will be outward instead of inward. The gas used as a furnace atmosphere is admitted into the retort through permanent piping in the base. The air in the retort is replaced with the neutral gas by purging. The bell shaped furnace is picked up by means of a crane and lowered over the retort, where it remains until the end of the heating cycle. During the heating cycle no attention is required as the heat control is entirely automatic. At the end of the heating cycle the furnace is raised and lowered over another retort for heating while the first is left to cool. In this way a full load is available every 4½ hours, thus making a continuous operation.

✦ ✦ ✦

THE operation of this furnace equipment indicated that a dry anneal of all sizes of wire is very desirable in most cases, so the General Electric Co., has developed a new furnace equipment to be used as a production unit for all sizes of wire, for large or small loads and varying production conditions.

✦ ✦ ✦

The New Batch Type GE. Annealing Furnace.

WITH the following points in mind the equipment shown in Figure 2 has been developed and can be called the latest word in batch type annealing. All the requirements outlined below are incorporated in its design and operation.

1. **Uniformity of anneal.**
2. **Variation of the furnace atmosphere in order that the furnace may be used for the annealing of metals other than copper.**
3. **Ease of loading and unloading.**
4. **Simplicity of the gas tight seal.**
5. **Short heating and cooling cycles.**
6. **Low first cost of equipment.**
7. **Low labor costs.**
8. **Low power requirements.**
9. **Flexibility in operation.**
10. **Portability.**
11. **A dry and clean anneal.**

THE equipment consists of a bell type furnace with multiple bases and retorts for the furnace loads. In each base a fan is installed for circulating the furnace atmosphere, thereby greatly accelerating the heating and cooling cycle. For the average factory one furnace and three to four bases will be required for continuous operation, varying with the density of the load.

✦ ✦ ✦

THE operation is as follows: (1) the charge is loaded upon the base, which may be at floor level or at any desired height; (2) the retort is lowered over the charge and seals itself gas tight by means of a water oil seal incorporated in the base; (3) the retort is purged of air using a suitable cheap furnace atmosphere, which is chosen for each application; (4) the furnace is lowered over the retort and, as the temperature control is automatic, no further attention is required until the end of the heating cycle; (5) at the end of the heating cycle the furnace is transferred to another base for heating the new charge while the first is left to cool (6). In addition to the

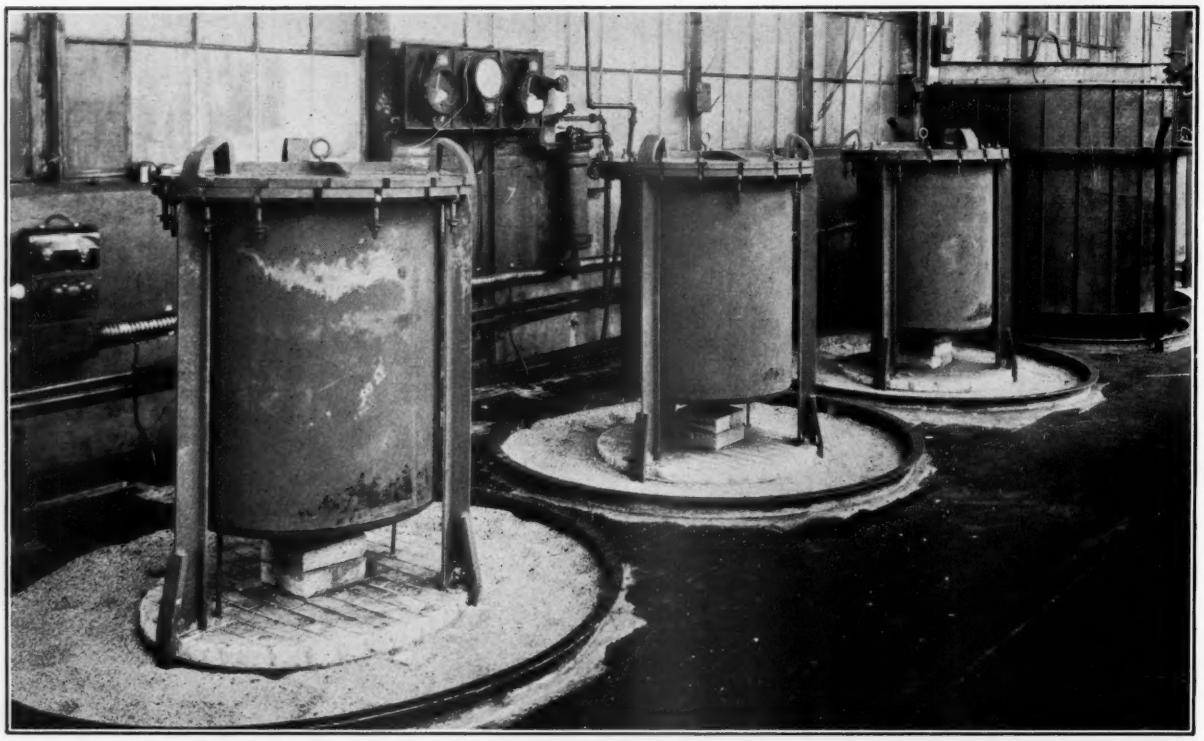


Fig. 1. G. E. Electric Furnace With Group of Retorts for Bright Annealing.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

more rapid cooling of the charge due to the incorporation of the fan, the cooling cycle may be shortened still further by the use of a water cooling system which is incorporated in each retort. (7) When the charge is cool the seal is broken simply by raising the retort and the charge is ready to unload.

✦ ✦ ✦

Requirements for Equipment

NOW to return to our outline of the requirements for this equipment let us see if each item finds its fulfilment.

✦ ✦ ✦

1. Uniformity of anneal. The following is report of the elongation throughout a load of wire annealed in this equipment. The requirements were that the elongation should exceed 25% with uniformity. The wire was loaded into the retort on large spools in six layers. The gross weight of the charge was 2712 pounds with a net weight of 2250 pounds of copper. After annealing, samples were taken from the outside, center and inside layers of spools taken from each of the six layers. The results were as follows.

	Outside	Center	Inside
Top row	32%	32%	33%
2nd row	30%	33%	31%
3rd row	30%	32%	32%
4th row	32%	30%	32%
5th row	29%	30%	33%
Bottom row	29%	33%	30%

2. Variation of the furnace atmosphere. This can of course be easily accomplished through the permanent piping in each base. The type of atmosphere can be varied with the nature of the charge.

✦ ✦ ✦

3. Ease of loading and unloading. As the loading level may be at the floor line or at any convenient height, the loading can either be by hand or by crane as the loading platform is flat with no obstructions on any side.

4. Simplicity of the gas tight seal. The seal consists of a ring of water or oil built into the base. To seal the charge the retort is simply lowered over the load. The base of the retort is emerged in this ring of liquid sealing itself. To break the seal the retort is simply lifted from the charge.

✦ ✦ ✦

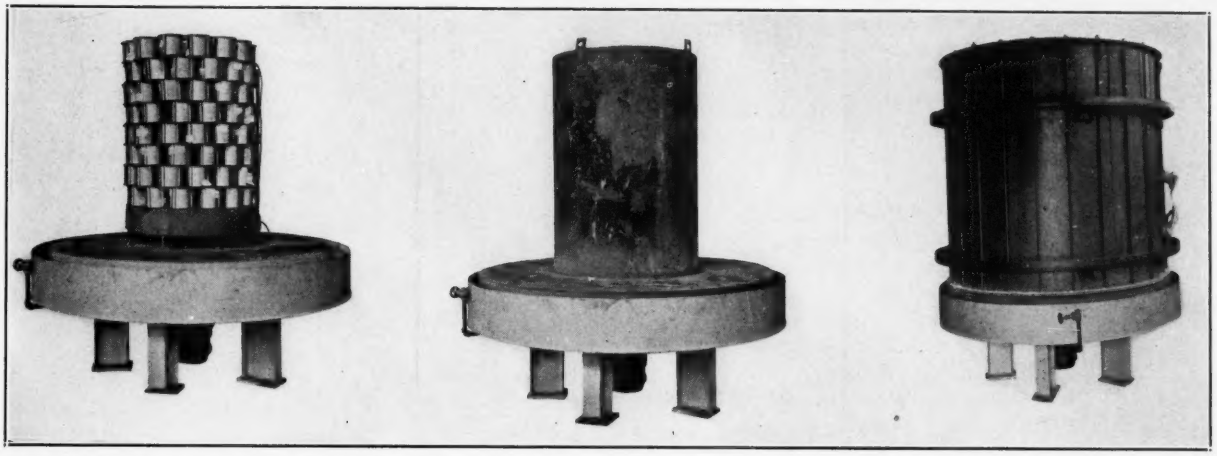
5. Short heating and cooling cycles. The length of the heating and cooling cycles will of course vary with the type and density of loading as well as with the temperature to which the charge is to be heated. For this discussion it will be sufficient to compare the overall cycle with that of the retort furnace which I have previously described. In that furnace the annealing of a ton of wire on spools requires about 4½ hours for heating and 18 hours for cooling. The same identical load in this furnace can be heated to the same temperature in 2 hours and 45 minutes and cooled in six hours.

✦ ✦ ✦

6. Low first cost of equipment. This item will be found to compare favorably with other equipment of a less modern type.

✦ ✦ ✦

7. Low labor costs. Very little handling of material by hand is required. During the heating cycle no attention is required as the temperature control is automatic. The loading an unloading time is cut to a minimum by the simplicity of the gas tight seal.



Bell type electric furnace with circulating fan for bright-annealing. Views showing load in position on base, cover hood in position over load, and heating chamber in position over covered load. ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

8. Low power requirements. In the test run mentioned under 1 of this outline, the economy of this furnace was 30.33 pounds per kwh.

✦ ✦ ✦

9. Flexibility in operation. Any size of wire can be annealed in this furnace as it operates equally well for a high or low temperature anneal. Any size of load can be run in the furnace without materially changing the economy figures. The furnace can be made in larger sizes with greater capacity than can the retorts without the circulating atmosphere, without greatly increasing the heating and cooling times.

✦ ✦ ✦

10. Portability. The furnace is easily portable without any dismantling as the bases are built as a unit as easily movable as the furnace itself.

✦ ✦ ✦

11. A dry, clean anneal. The work is dry and as clean as when it enters the furnace.

Special Bronze For Telephone and Telegraph Conductors

PART III—WIRE DRAWING, DIES AND LUBRICANTS

Translated from Chemisch-Metallurgische Zeitschrift of August 8, 1931

By Samuel J. Rosch, Cable Engineer
Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.
Assisted by Otto F. Jagielski, Consulting Wire Mill Engineer

PARTICULAR attention must be paid to the means of adjustment provided in the case of rolls having oval shaped grooves, the adjustment being judged by rolling several samples. When the adjusting screws are lowered too tightly, the material which is being rolled has a tendency to squeeze out sideways from the groove and in the case of the oval, it more or less produces a large fin. This fin, when passing through the next round or square pass, has a tendency to turn in and this is rolled in with the metal. A rod drawn in this manner, shows a tendency towards scale formation, in the wire which is drawn from it. Aside from the poor appearance of the surface of the wire, in such spots where the fins and scale appear, one side of the cross-section is somewhat weakened, while the other already shows a small fissure. During the mechanical testing for tensile, bending and torsion, this fissure is further enlarged, thereby producing untimely failure prior to having reached the desired values. It is therefore very important to have careful workmanship.

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BRONZE wire having a finished dimension of 2 mm. round and smaller, is rolled to 10 mm. Should the finished dimension be greater than 2 mm., the wire is rolled to 14 mm diameter. If one should desire to produce wire greater than 2 mm. dia. from 10 mm. rods, the resulting number of draughts would be smaller, but the finished wire would not possess the necessary hardness and tensile strength.

Wire Drawing

THE coiled rods which arrive from the rolling operation in diameters between 10 to 14 mm., are first pickled in a solution of sulphuric acid, then washed with water and dried. This is followed by the cold drawing of the wire to the completed dimensions. For this operation, various types of draw benches are used, which varying with the tensile strength of the materials to be drawn, can be divided into three groups, as follows:

(1) **The coarse draw bench,** which is also used for trolley wire. These are very heavy draw benches on which the rods are drawn down to a diameter of 6 mm.

(2) **The medium draw bench** which draws the rod from 6 mm. to 4mm., and

(3) **The fine draw bench** which draws the 4 mm. diameter material to the finished dimensions.

✦ ✦ ✦

THE coarse and medium benches make only one reduction in order to produce their respective diameters, but the fine draw bench arrives at its finished dimension by means of many reductions or stages.

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THE amount of work in the cold drawing depends on the finished diameter of the wire. As mentioned above under hot rolling, wires having a finished diameter of 2 mm. and larger, are drawn from a 14 mm. rod.

✦ ✦ ✦

WIRE having a finished diameter of 4 mm. receives the following draughts: During the coarser reductions, it receives the following draughts:

From	To
14 mm.	12.5 mm.
12.5 mm.	11.0 mm.
11.0 mm.	10.0 mm.
10.0 mm.	8.5 mm.
8.5 mm.	7.1 mm.
7.1 mm.	6.0 mm.

✦ ✦ ✦

During the medium reductions, it receives the following:

From	To
6.0 mm.	5.3 mm.
5.3 mm.	4.6 mm.

✦ ✦ ✦

During the finer reductions it is reduced from 4.6 to 4.0 mm.

✦ ✦ ✦

WIRES having the diameters of 2.5, 3.0 and 3.5 mm. receive the same draughts during the coarser reductions, as mentioned above. This means from 14 mm. to 6 mm. It is only during the medium and finer reductions that the practice changes.

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THE medium reductions are made as follows:

From	To
6.0 mm.	5.1 mm.
5.1 mm.	4.2 mm.

✦ ✦ ✦

THE finer reductions are made as follows:

	From	To	
	4.2 mm.	3.5 mm.	finished dimension
or	4.2 mm.	3.5 mm.	
	3.5 mm.	3.0 mm.	finished dimension
or	4.2 mm.	3.5 mm.	
	3.5 mm.	2.9 mm.	
	2.9 mm.	2.5 mm.	finished dimension

✦ ✦ ✦

WIRES having a finished diameter of 2 mm. and smaller, are processed from 10 mm. rod and receive the following individual passes.

✦ ✦ ✦

THE coarse reductions are made as follows:

From	To
10.00 mm.	8.5 mm.
8.5 mm.	7.1 mm.
7.1 mm.	6.0 mm.

✦ ✦ ✦

THE medium reductions are made as follows:

From	To
6.0 mm.	5.1 mm.
5.1 mm.	4.2 mm.

✦ ✦ ✦

THE finer reductions are made as follows:

From	To
4.2 mm.	3.5 mm.
3.5 mm.	3.0 mm.
3.0 mm.	2.5 mm.
2.5 mm.	2.1 mm.

or

4.2 mm.	3.5 mm.
3.5 mm.	3.0 mm.
3.0 mm.	2.5 mm.
2.5 mm.	2.0 mm. finished dia
2.1 mm.	1.7 mm.
1.7 mm.	1.5 mm. finished dia.

✦ ✦ ✦

Dies

FOR drawing material, steel dies can be used; however, their manufacture and grooving entails considerable skill and experience. The steel dies have this characteristic, that during the drawing operation they do not hold the dimensions continuously unless they are hardened properly. It is therefore recommended that they be used only during the coarse and fine draughts, because during these operations, it is not necessary to hold the dimension down to one-tenth or one-hundredth of a millimeter. The fine draughts, however, should under all circumstances be accomplished with precious stone dies. It is even recommended that precious stone dies be used even during the coarse and medium draughts, in order to avoid considerable aggravation. My experience has shown that the stone dies made by Krupp of Magdeburg, are very good for this purpose. I have on many occasions drawn many tons of wire with one of these stone dies, without having the wire change its dimension by even one-hundredth part of a millimeter. If however, during the course of time one of these dies becomes worn, it is quite simple to grind it to the next larger dimension.

✦ ✦ ✦

Lubricants

AS a lubricant during the cold drawing, rapeseed oil is used. A very successful arrangement, which is recommended to be used on each draw bench before each die consists of a simple box made of tin, in which are provided two rolls on the inside and one on the outside, with provisions for holding the die at the end of the box. The wire which leaves the unwinding reel, passes over the outer roll, through a slit in the box, under the first roll in the box, through the rapeseed oil, over the second roll and onto the receiving reel. This simple arrangement offers the following advantages:

(1) A very good oil lubrication with economy in its use. The excess oil drips back into the box.

(2) During the drawing operation considerable metal dust is made which without such arrangement would be lost. This dust, however, falls down in the box, together with the excess oil. When it is decided to renew the oil, the old oil in the box is poured into a barrel. In this barrel the fine metal dust settles to the bottom in the form of scum and provides a valuable raw material for copper refining. The oil which remains over this scum can be used over as a lubricant.

(3) If the second roll in the tin box is installed in such manner that it is very close to the die and the bottom of its periphery is still immersed in the oil, then during the rapid rotation of the roll, considerable oil is carried on its surface and spattered over the die. Apart from the lubrication, this also has the tendency to cool the die and thereby prolong its life.

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Special Alloys

IN conclusion, there is still another special alloy mentioned. In many cities from the point of view of safety, they do not use copper as the overhead conductor for street railways, but instead, use a bronze wire having higher tensile than copper. These wires, besides having certain specified tensile strength, must also possess a given conductivity. As an example, we mention the bronze wires which are required by the Vienna and Grazer Street Railway. This is a cadmium bronze which has a tensile strength of 48 kgms. per sq. mm. and a conductivity of 48 at 15°C. These wires are trolley wires, usually of special section and ranging from a cross-section of 65 to 100 sq. mm. Besides that, definite lengths are often specified, in other words, coils weighing 250 kghs. in one continuous length without brazes are required. Such a bronze possessing a tensile strength of 48 kgms. per sq. mm. and a conductivity of 48 at 15°C. is alloyed from:

Copper	**—150 kgms.**
Metallic Silicium	**—9 gms.**
Red Phosphor	**—5 gms.**
Tin	**—62.5 gms.**
Cadmium	**—1000 gms.**

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IN regards to the use of the raw materials, the same precaucautions are to be observed as mentioned under the alloying of telephone bronzes. It is also necessary to pour the metal as hot as possible and the same procedure followed during the alloying, as mentioned before. However, since in this case it is necessary to pour larger bars, it becomes necessary to change the dimensions of the molds. The molds for these bars have a diameter of 150 mm. and a length of 1700 mm. Such a bar has a weight of approximately 300 kgms. If one does not possess a crucible large enough to take such a charge, or if there are other reasons why the furnace is not adaptable for such large crucibles, then it is advisable to use two crucibles containing the proper weight and when the metal is poured into the mold, it is poured into the funnel from both crucibles simultaneously. This simultaneous pouring is possibly not so good,

(*Please turn to page 58*)

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REGISTRY OF USED WIRE MILL MACHINERY

Industry In War

By Captain Charles T. McAleer, Signal Corps, U. S. Army,
Chairman of Wire and Cable Commodity Committee No. 51
War Department, Washington, D. C.

This Paper Presents a Study of Industry and the Conditions which it Faces in the Event of a National Emergency. The Ideas Advanced are the Personal Expression of the Author and are not in Any Way to be Considered as Official. ▼ ▼ ▼

NATIONAL characteristics, subject as they are to geographic and climatic influence, are as much a function of environment as are acquired characteristics of the individual. Just as the continued contemplation of a vast, unclouded sky by the people of Egypt was reflected in the enormous scale of their architectural enterprises, so also was the tremendous expanse of virgin territory, coupled with a vigorous pioneer spirit and certain economic advantages, reflected in the immense scale of industrial organization and building activity that made this nation an outstanding figure among the industrial nations of the world at the outbreak of the world war.

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THE foundation for America's great effort in that titanic struggle was laid in the reconstruction period following the Civil War. This period saw an industrial expansion never before known in the history of the world, and impossible of duplication in all of its ramifications in any other country but America.

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INDEED, America's position in this respect was unique. At a time when steam and electric power were just coming into their own, this nation of energetic and inventive people found itself in possession of almost unlimited natural resources. Industry grew from small, struggling firms, doing business of a local character, to gigantic combines whose influence was national in scope. So closely interwoven with the life and welfare of the nation were these vast organizations, that a demand soon arose for some form of governmental supervision.

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THE first agency of any importance set up for this purpose was the Interstate Commerce Commission, established in 1887. This was later followed by the Departments of Agriculture, Commerce, and Labor. Writers all seem to agree, however, that the most important existing organization at the time of the war was the Federal Reserve Board, created in 1913. By dividing the country into districts, with a Federal Reserve Bank in each district, this board was able to exert a control over national finances that proved highly valuable during the war.

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ONE of the characteristics of a pioneering people is fearlessness, but this trait, unfortunately, has a tendency to encourage such people to depend upon a native courage and resourcefulness in times of emergency, rather than upon carefully prepared defenses. Such procedure is, however, generally expensive in both manpower and capital; and, realizing this, several movements were instituted after the Spanish-American War, looking toward a more adequate organization of the military and naval forces of the nation. These efforts, as a rule, met with but little success, due not so much to a preponderance of pacifistic sentiment, as to the belief that such preparation was not necessary in a country far removed from the possibility of invasion; and due also to a belief that too much power delegated to the military and naval establishments in time of peace was not desirable in a republic.

THIS latter belief has no basis in fact. Napoleon Bonaparte, at the height of his military career, realized this, and on May 4th, 1802 wrote:

> "In every country force bows to the civilian virtues. The bayonets fall before the priest who speaks in the name of religion, and before the man of science. I foretold that a military government would never take in France unless the nation were degraded by fifty years of ignorance. Every attempt would fail, and their authors would be the first victims. It is not as a general that I govern, but because the nation believes that I have civilian qualities that make me fit for governing, otherwise the government would not maintain itself. I knew what I was about when, as a general, I assumed the title of Member of the Institute; my meaning was clear even to the last drummer of the army.
>
> "We cannot argue on the analogy of the dark ages. We are thirty millions of men held together by enlightenment, property, and commerce; three or four hundred thousand soldiers are nothing in such a mass. The soldiers themselves are the children of the citizens. The army is the nation."

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FURTHERMORE, there existed in the mass mind a belief that a willingness to volunteer for service was sufficient preparation for national defense. Little thought had been given to the question of what might be the industrial load thrown upon the nation by the requirements of a huge modern army.

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PREVIOUS to our entry into the war, the question of supply for the various arms and services had been a very simple problem. With only a small regular army to maintain, orders were placed with firms and filled by them in much the same way that commercial orders were taken care of. No great strain had been placed on industry, due to the fact that types of equipment were few in number, and comparatively simple in design. Few people realized how extensive and complex had become our modern industrial organization, and consequently the general public was unable to understand that industry required considerable time for tooling up before get-

ting under way for mass production on a large scale. Especially was this true in the case of thousands of military items, many of which were in the new fields of aircraft, radio, and heavy artillery, presenting difficulties of manufacture which at times seemed insurmountable.

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FURTHERMORE, the simplicity of our purchasing problems had acted to inhibit the growth of adequate procurement agencies capable of handling the terrific load thrown upon the military forces with the declaration of war on April 6, 1917. At that time, altho entering upon the greatest war in the history of the world, little thought had been given to the number of troops to be engaged, and some of the supply branches, in order to get started on their equipment program, made arbitary estimates on the basis of 500,000 men. This was soon raised to 1,000,000, and before the end of the war, requirements were being computed on the basis of 5,000,000 men.

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DURING these days of feverish activity, turmoil, and confusion, the one agency that should have been able to coordinate the activities of an army during the period of mobilization was the General Staff, but this organization was, by law, woefully inadequate for the task confronting it. Our General Staff was first organized on February 14, 1903, with a maximum of 45 officers under a Chief of Staff who, at the direction of the President, through the Secretary of War, was charged with the supervision of all troops of the line, and of all War Department Bureaus. This body, upon which fell the burden of all war plans was, in 1912 reduced to 36 officers. It was further handicapped in 1916 when, altho increased to an attainable maximum of 55 officers, it was limited to only half that number for duty in Washington.

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HERE was an organization, charged with making plans for the greatest war in history, and faced with a mobilization of manpower and industrial resources that was to strain our national structure to the limit, with an authorized strength of only 41 officers, and of these, only 19 available for duty in Washington. No wonder that plans were few, and just as inadequate as was the size of the organization designated to make them. At the outbreak of war, the General Staff of the German Army was composed of approximately 650 officers; that of France, 644 officers; and that of Great Britain, 232 officers.

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WE cannot say that the nation was not warned of the pitfalls of unpreparedness, for the cause of defense had many champions. Outstanding among these was General Crozier, who, from the time of his first appointment as Chief of Ordnance in 1901, had advocated an increased artillery program, based upon the great length of time that would be required to provide any appreciable amount of artillery in the event of a major emergency. Other efforts were made by interested citizens from time to time, but little was accomplished until after 1914, when certain far-sighted individuals realized that it would be only a matter of time before this nation would become involved in the struggle then going on, and that in such an event, demands would be placed on the nation that would tax its industrial resources to the limit.

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OUT of the hazy beginnings of 1915 there emerged three official movements directed toward industrial mobilization, in addition to that provision of the National Defense Act of June 3, 1916 which empowered the President in times of emergency to place orders for war supplies without competitive bids, and authorized him to fix prices and commandeer plants when necessary.

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FIRST of these was the Industrial Preparedness Committee of the Naval Consulting Board, which in 1916 made a survey of some 18,000 industrial plants; an effort which at that time was somewhat premature because of the lack of definite plans.

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NEXT came the Kernan Board, appointed by the Secretary of War under provisions of the National Defense Act, which made a study of the nation's resources with a view to determining the feasibility and practicability of certain recommendations for the government manufacture of munitions and equipment. Other than expansion of existing plants, the opinion of the board was against the exclusive manufacture of munitions by the government.

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FINALLY, the Army Appropriation Act of August 29, 1916 authorized the formation of the Council of National Defense, to consist of the Secretaries of War, the Navy, the Interior, Agriculture, Commerce, and Labor. Provision was also made for an Advisory Commission to consist of not more than seven members, each having special industrial qualifications of value to the Council. The Council's chief functions were declared to be:

(1) The coordination of all forms of transportation and the development of means of transportation to meet the military, industrial, and commercial needs of the nation.

(2) The extension of the industrial mobilization work of the committee on industrial preparedness of the Naval Consulting Board. Complete information as to our present manufacturing and producing facilities adaptable to many sided uses of modern warfare will be procured, analyzed and made use of.

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DURING this formative period, two other steps were taken which had a direct bearing on the manner in which our resources were mobilized for a maximum effort against the enemy. One was the creation of the United States Shipping Board, under the Federal Shipping Act of September 7, 1916, and the other was the limited organization of the General Staff, previously referred to, established under the provisions of

the National Defense Act of June 3, 1916.

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THE nation's great industrial weapon had received some stimulus and educational value from allied war orders, which had an appreciable influence in organizing our powder industry along the lines of munitions manufacture. At the outbreak of the war in Europe, the powder making capacity of the United States was approximately 50,000 pounds a day, whereas, at the time of our entry, this had been increased to about 1,250,000 pounds a day. Altho this had the advantage of focusing our attention on such strategic items as nitrates, manganese, tin, chromium, nickel, mercury, platinum, tungsten, and many others, it had the disadvantage in many instances of committing us to certain lines of action which could not be changed without great loss of time and money. Another disadvantage was the market congestion and effect on prices created by uncontrolled competition, one example of which is the fact that after the introduction of gas by the Germans, the price of Bromine went up 1670 per cent.

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THIS was our position in 1917. With an industrial capacity for mass production second to none, we found ourselves with no means for converting this vast machine to war time use. Yet, beginning without plans, and for a while without even an idea of what our maximum effort was to be, we build up the strongest and greatest industrial machine ever produced for war purposes.

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LET us consider for a moment the difficulties under which this was accomplished. At the outset, the various governmental bureaus and departments, in attempting to expand, found themselves hampered by a mass of restrictive legislation which obstructed all except those bold enough to ignore them. One statute forbade the hiring in Washington of any employees other than those especially authorized by law. Another prohibited the renting of office space in Washington unless authorized by an appropriation for the specific purpose.

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HANDICAPPED by the fact that all activities were centralized in Washington, this inability to properly expand only added to the confusion and made worse the conditions under which the supply branches were trying to function. Restrictions were even placed on buildings and real estate, to such extent that only temporary buildings could be erected anywhere in the United States. Oft-times the need for certain services was of such urgent nature that contracts were let before funds were made available by the slow process of law, thus subjecting the patriotic officer concerned to the penalties involved by so doing. Even though funds were available as surplus under one appropriation, they could not be used for purposes not coming within the classification of this appropriation, no matter how urgent the need.

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BRANCHES had no plans other than for their immediate needs, nor had they made any investigation of either the sources of raw materials, or the facilities to convert them into finished products. Most of our equipment was non-commercial in type, and much of it was based upon developments of the war, which made it difficult for manufacturers to get into production. To aggravate this condition, no provision had been made for the development of plans and specifications, and consequently, these often had to be improved as work progressed. This necessitated frequent changes after articles were put into production, with consequent confusion and delay.

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EACH branch and bureau, not knowing just how much of any item to procure, and not wishing to fall down on their program, went into the market with greatly inflated estimates, thus creating shortages that need not have existed. This competition and conflict existed not alone between the branches of the Army and Navy, but between the civilian institutions and Allied purchasing agencies as well. No provision had been made for coordinating the procurement activities of the various branches of the Army and Navy, nor did any means exist of regulating the flow of raw materials, or the demands upon power and transportation. Such was the congestion at one time around the port facilities of New York and New Jersey, that loaded cars stood on tracks for miles outside these cities until enforced embargoes on shipments relieved this condition.

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THIS congestion was a natural consequence of the peculiar geographic concentration of industry in the North East section of the United States. Of necessity, orders were placed in these fifteen leading industrial states of the nation, and in some states, such as Connecticut and Delaware, this led to overloading out of all proportion to their normal capacity, with serious results to production.

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UNLIKE Germany, this nation had built up no reserve of nitrates, or other raw materials difficult of procurement in time of war. A most inadequate stock of 600,000 Springfield Rifles, based upon our conservative estimate of an army of 500,000 men was our only war reserve. Before the end of the war we had 312,878 Springfields, and 2,193,429 Enfields.

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AS previously mentioned, the council of National Defense was originally organized as a peace time body which should prepare the country for war by means of study rather than action, and was totally unprepared for the terrific burden thrown upon it by the confusion and congestion of the early days of the war.

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THE Advisory Commission, which was the backbone of the Council, held its first meeting in December, 1916. By February, the seeds had already been sown for the Government Railroad Administration, which was to follow, and the commission had divided itself into seven committees, comprising Transportation, Raw Materials, Munitions, Supplies, Engineering, Labor, and Sanitation.

BY March 31st, the Council and Advisory Commission realized the necessity for a more extensive coordination and control of purchasing and manufacturing, and recommended the appointment of a Purchasing Committee, to be composed of Army and Navy Department heads, or representatives, and representatives of the Advisory Commission. The formation of this committee was the first step toward coordinating the buying of the several departments of the military and naval establishments. At about the same time the Council created a board known as the Munitions Standards Board, for the purpose of coordinating the activities of the Army and Navy Departments in their effort to standardize the various tools, dies, jigs, etc., then being used in the manufacture of munitions.

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THESE two activities were later combined under the heading of the General Munitions Board, which was composed of representatives of the War and Navy Departments and six civilians, exclusive of the chairman. This new board enlarged its activities by appointing a number of subcommittees on Army Vehicles, Armored Cars, Emergency Construction Contracts, Optical Glass, Storage Facilities, Machine Guns, Priority, and Accountancy.

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IT was under the direction of the Committee on Emergency Construction Contracts that the greatest single task of the war was undertaken. This was the construction of 32 cantonments, each a city capable of housing 40,000 men, with the necessary street, lighting, water, heating, and sewerage systems. This work, said to be of greater magnitude than the Panama Canal, was planned, designed, and contracted for between May and July, 1917.

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THE general functions of this board were the coordinating of purchases by the Army and Navy and assisting in the acquisition of raw materials, in an effort to establish the precedence of orders between the Army and Navy and between the industrial needs of the country. Thus began the all-important clearance function, which was to exert so much influence later in regulating competition between departments.

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THE Board drew from the important industries of the country for its personnel on these committees, and this fact led to much criticism on the grounds that these firms were doing business with themselves. The Board was not, however, a purchasing organization, this being done by the various departments of the Army and Navy, under the supervision of the Board.

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THE Board's authority and scope of its activities were, however, rather vaguely defined, and it was soon found that there was considerable overlapping of work done by its committees and those already established by the Advisory Commission of the Council of National Defense. The Board discharged most of its functions by negotiation with interested parties concerned, and had no real authority to compel obedience to its decisions. It also developed a tendency to create too many committees and subcommittees, with consequent loss of decisive power and action.

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THIS led to the creation on July 8th, of the War Industries Board, which had, in place of the twenty-two members of the General Munitions Board, a Chairman and four commissioners (Raw Materials, Finished Products, Priority, and Labor) in addition to one representative each from the Army and Navy.

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THIS board took over the work of the numerous committees on Raw Materials and Supplies that had been operating under the Advisory Commission of the Council of National Defense. The usefulness of these committees was in this way increased, and the cause of former criticism was removed, as the members of the War Industries Board were now representing only the Government, and were entirely removed from all connection with the firms from which they were drawn. Contact was had with industry by means of various War Service Committees, composed of members designated by the industries themselves, and clothed with complete power to act. The Chamber of Commerce of the United States was largely instrumental in this work. Among other things undertaken by the board was the development of resources and providing means of increasing production. Price-fixing was also attempted, but with little success in industries other than steel and cotton.

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DURING the fall of 1917, Congress established the Food, Fuel, and Railroad Administrations, the Shipping Board, and the War Trade Board. Of this group, the Shipping Board, and the War Trade Board. Of this group, the Shipping Board, the War Trade Board, and the War Industries Board all passed on imported Raw Materials.

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IN August, 1917, there was created the Allied Purchasing Commission, composed of three members of the War Industries Board and a business manager. It was the purpose of the commission to assist the Allies in obtaining the best prices, terms of delivery, priority preference, etc., that was practicable. This effort to coordinate Allied buying with our own greatly simplified the problem of high prices arising out of unrestricted and uncontrolled competition.

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THE War Industries Board was still without a well defined legal status, and amidst the turmoil and confusion it became increasingly difficult to enforce its decisions upon the procuring agencies. Furthermore, it lacked centralization of responsibility and decentralization of authority, which lack manifested itself in endless discussions and committee meetings, with great loss of time, when time was almost priceless.

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THESE things led, on March 4, 1918, to a reorganization of the War Industries Board, by authority of a letter from the President, delegating supreme

authority to the chairman of the Board, and investing him with all the legal backing previously denied the Board. No reorganization was made, but the chairman immediately proceeded to decentralize authority, while still retaining responsibility.

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THE Price-Fixing Committee was not formed until March 14, 1918. The findings of the committee were reported directly to the President, who assumed full responsibility, thus removing this committee from the jurisdiction of the War Industries Board and putting to an end all opportunity for criticism. The activities of this committee did not touch upon food and fuel.

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THE position of the War Industries Board was again fortified by an executive order of May 28, 1918 which separated the activities of the War Industries Board and those of the Council of National Defense, thus placing the Board directly under the President.

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THE Requirements Division of the Board was formed in June, 1918. This was an effort on the part of the Board to anticipate the requirements of the several purchasing agencies in order that raw materials might be more effectively organized.

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THE Priorities function of the Board was forced upon it by the insistent demands of manufacturers for instructions regarding the precedence of War Contracts. Although having an ample background, the Priorities Committee seldom had recourse to legal action because of the splendid spirit of cooperation exhibited by most of the people with whom they had dealings. Through the cocooperation of the Railroad Administration, the Board was able to exert considerable pressure by means of the priorities provision of the Act of May 29, 1917 amending the Interstate Commerce Act. As the Food and Fuel Administrations also worked in close cooperation with the War Industries Board, recalcitrants were soon brought into line by withholding any one of these three essentials. The power of the committee lay in the fact that its actions took the form of assistance to the industries concerned. Orders were rated in accordance with their relative importance for war purposes, and preference given such orders in the fields of power, fuel, and transportation. All orders were rated either by the issuance of priority certificates to the persons placing the order, or by a system of automatic ratings. Furthermore, facilities were assisted in the process of production by the issuance of "Classification of Purposes Demanding Preferential Treatment", followed by a series of "Preference Lists".

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IN order to facilitate the work of the committee, there was set up on July 1, 1918 (the day on which control was extended to all industries) a scheme of Automatic Classifications. These operated to remove the mountainous mass of detail under which the committee was being swamped.

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AS previously mentioned, Price-Fixing was removed from the jurisdiction of the War Industries Board and placed directly under the President. The problem was never satisfactorily solved, and is likely to be one of major importance in the next war. No effort was made to arbitrarily fix prices, but instead, control was effected by negotiation and agreement with the industries concerned. It is believed that an intelligent analysis of statistics will show that very little control was exercised over prices, and that what downward trends did develop were due almost entirely to the influence of existing economic conditions.

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PARALLELING the work of the Priority Committee was that of the Committee on Conservation of Resources. By means of restrictions placed on the uses of non-essential items and luxuries, many facilities were released for war purposes. The development of substitutes; elimination of waste; and the discovery of new sources of supply was also a function of this committee.

LABOR control, although closely related to other functions of the War Industries Board was largely in the hands of outside agencies, and was not effectively realized until near the close of the war. When the Labor Commission of the Council of National Defense was created, there already existed in the Department of Labor three Bureaus that exerted considerable influence on the problem of Labor control during the war. The United States Board of Mediation and Conciliation was created to settle Railroad difficulties; the Mediation Service, to deal with general Labor troubles; and the United States Employment Service, comprising 20 zone offices and 62 sub-branches, to assist in the allocation of Labor.

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IN order to check the disastrous migration of Labor, and among other things, to provide a means for training and adjusting disputes, a Labor Commission and a War Labor Conference Board were created in January, 1918. This Board was the forerunner of the National War Labor Board, known also as the "Taft Walsh Board". As this Board was an administrative institution, concerned chiefly with settling disputes, the need was soon felt for an organization designed to coordinate the Labor problems of the various war agencies.

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IN May, 1918, therefore, the War Labor Policies Board was created. This Board, in addition to a chairman, consisted of representatives from the Secretary of War; the Navy Department; Department of Agriculture; Labor Division of the War Industries Board; Fuel Administration; Shipping Board; Emergency Fleet Corporation; Food and Railroad Administrations. The Board functioned as an interlocking directorate, and was concerned chiefly with questions involving distribution of Labor, wages, working conditions, etc. No attempt was made to fix a flat rate for wages, but instead, local conditions were allowed to influence the wages established in any community. This work was later

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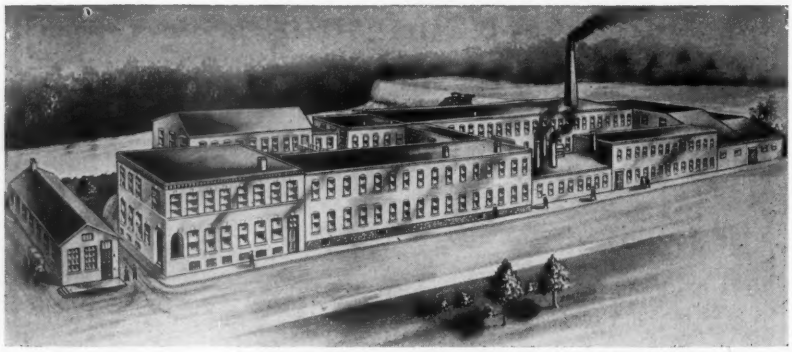

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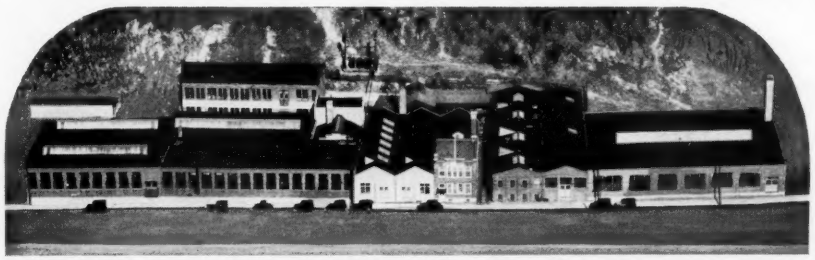

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Expert annealing of the wire prevents unnecessary breakage when winding the wire into coils. ▲ ▲ ▲

If you, too, have a specific problem demanding wire of exact requirements, write to us about it. ▲ ▲ ▲

It costs nothing and involves you in nothing. ▲ ▲ ▲

Better wire at lower cost. ▲ ▲ ▲

We can serve you quickly and economically.
Send in your specifications for a quotation.

"HUDCO"
FINE WIRES

HUDSON WIRE COMPANY

Ossining, N. Y.

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greatly decentralized by making use of existing local organizations. An important phase of the Board's work was the organization of War Prison Labor, and the National Waste Reclamation Section. Wage-fixing, like price-fixing, was one of the unsolved problems of the war.

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THE Commodity Section of the War Industries Board has been said to be the backbone of the whole structure. This committee was composed of 57 Commodity Sections, headed by the strongest men from their respective industries. Contact was made with industry through the various commercial committees previously mentioned, thus facilitating the functioning of the other branches of the Board. These committees furnished expert information and directed the enforcement of regulations and control.

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PRELIMINARY steps taken to discover the resources of the nation have already been referred to. An Industrial Inventory Section of the Board was formed to take over the functions of these earlier committees, and later expanded to include (1) Resources & Conversion Section, for discovering plants and supervising their conversion. (2) Facilities Division, for supervising construction of new plants. (3) Advisory Committee on Plants and Munitions. (4) Division of Planning & Statistics.

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BY May, 1918, 28,000 plants had been inventoried. The United States Chamber of Commerce and the Association of Fire Underwriters assisted in this work. An endeavor was made, through clearance, to spread the development of industry from the congested Eastern Section to other parts of the country. The nation was divided into 21 geographic areas, with a regional advisor in each. These advisors each headed a committee composed of a representative from each of the principal war industries in his district. In this way much work was decentralized, and the congestion in Washington was relieved. This committee gradually expanded until its activities somewhat resembled the Procurement Planning and Current Procuring Sections of today.

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THE Railroad Administration, although controlling a facility vital to the success of the War Industries Board, worked in such harmony and close cooperation that no need was felt for control. Of great service was the exercise of the priorities function over shipments in transit.

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SUCH was not the case with the Shipping Board, and a need was always felt for closer relationship of this means of transportation with industry and railroads.

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ANOTHER important function lost to the War Industries Board was the control of fuel. This was early turned over to the Fuel Administration, and, although cooperation was complete, the lack of control of this essential item related as it is to power and transportation, was always keenly felt.

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THE Food Administration, which was established together with the Fuel Administration by the Lever Act, was not so closely related to the work of the War Industries Board, and seems to have been handled in the best possible manner.

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THE War Trade Board was established by executive order of October 12, 1917, for the purpose of regulating imports and exports. Pressure brought to bear by this board was responsible for the release of the Chilean nitrates.

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THE Federal Reserve System, previously mentioned, was the foundation upon which was built the agencies for war time control of finances, need for which was outlined in the report of the Secretary of the Treasury for 1917. The Capital Issues Committee was organized by the Federal Reserve Board for the purpose of controlling the issue of securities by war time industries.

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THIS agency had no legal authority, and in April, 1918, Congress established the War Finance Corporation, which included the functions of the previous committee and in addition was charged with the duty of aiding war enterprises to secure operating capital. Its success in this work was largely due to the cooperation of financial institutions throughout the country.

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OUT of the storm of criticism directed at the conduct of the war in 1918 there arose the Purchase, Storage and Traffic Division of the Army. First conceived in the reorganization of the General Staff by General Order 14, of February 9, 1918, it was formed in April by the consolidation of the Departments of Purchase & Supply, and Storage & Traffic. This organization paralleled somewhat the War Industries Board, and was an attempt on the part of the General Staff to coordinate Departmental purchase and transportation problems in the manner previously done by the War Industries Board. It did not replace, but supplemented this Board's activities. Its functions were much the same as those of the Quartermaster Corps, as it did not attempt to make purchases in highly specialized technical fields.

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THIS is a general survey of what was done in the past to convert our industrial machinery to war time uses. Mistakes, as well as accomplishments, are shown. It is in order to prevent a repetition of such mistakes, and possibly avoid others, that we now recognize the following ten principles as being almost fundamental in planning for a future emergency:

(1) For any possible emergency, the maximum effort must first be determined. Such emergencies should be anticipated, as far as possible, by properly executed war plans, with sufficient flexibility to meet changing conditions.

(2) On the basis of such plans, troop requirements should be computed in advance.

(3) On the basis of these requirements, surveys of industry should be made, in order that facilities may be allocated to the various procuring branches, and raw material sources investigated, thus preventing inter-branch competition, with resulting confusion and delay when war is forced upon us.

(4) When it develops that facilities are inadequate to meet requirements, provision should be made for the establishment of reserves, or for the development of suitable facilities in time of

(Please turn to page 58)

'Round the World With the Wire Industry

New British Steel Merger

AT the beginning of December British industrialists welcomed an important step taken by Stewarts & Lloyds in the reorganization of the British steel industry, welcoming at the same time the work done by the Bankers' Industrial Development Co., in obtaining the finance for such developments. The close of the same month brings the news of another step in the reorganization, in which the Bankers' Industrial Development Co. is again concerned, and this time the step is of special interest because of the big wire interests it involves,. It concerns the acquisition by the Lancashire Steel Corporation of the Whitecross Co., Warrington, one of the largest wire manufacturing organizations in Europe. This enterprise produces wire and wire products on a large scale, turning out a class of finished products similar to those of Rylands Bros., which is one of the constituent companies of the Lancashire Steel Corporation.

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THE formation of the Lancashire Steel Corporation was in itself an important step in the rationalization of the industry. It was formed to take over the control of the iron and steel interests of the Partington Iron & Steel Co., Rylands Bros., Pearson & Knowles, and the Wigan Coal & Iron Co., all located in Lancashire County, and a plan was drawn up for the consolidation of all these businesses as one producing unit. This scheme involves new construction work to the value of approximately $8,750,000.

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THE project is now carried a step further. A new continuous wire rod mill is to be constructed which will be one of the largest and most modern in existence. It has been planned in accordance with the best practice devised during recent years. Steel wire rods will be manufactured from raw material to finished product on one site. The process will begin with the iron ore and coal and will be continuous through the manufacture of coke and pig-iron to the steel ingots, blooms, billets and wire rods. Thus transport from one works to another, which was the old practice, will be eliminated, with a resultant lowering of costs of production. It is intended that the great wire works of Rylands Bros. and the Whitecross Co., besides other important consumers of wire rods in Lancashire, shall be supplied from the new plant.

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THE mill will produce products such as wire-netting, barbed wire, and wire nails, made solely from local materials. Hitherto very large quantities of either billets or wire rods have been imported from Continental Europe for the manufacture of these products in Britain, but it is hoped that the new mill's products will compete successfully with the Continental rods.

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THE project is very encouraging to British heavy industry because it reveals confidence in the outlook and also represents practical and effective preparation for the times of better trade which sooner or later will return. As in the case of the Stewarts & Lloyds reorganization scheme, the most important feature is the concentration in one place of all the processes of manufacture.

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Big British Screw Concern Reorganizing

AN early capital reorganization is foreshadowed in the report of British Dardelet Threadlock Co., which was formed in 1929 and, so far, has paid no dividend. Negotiations, it is stated, have reached a satisfactory conclusion. During January a special meeting will be called to consider resolutions for a capital reconstruction and for the removal of all distinction between the present "A" and "B" shares. Pending completion of these arrangements the necessary finance for the firm's requirements has been arranged.

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ACCOUNTS for the 14 months to August 31 last reveal a total loss of £29,304 ($146,520), increasing the accumulated debit balance to £75,740 ($378,700). The turnover in Dardelet bolts and screws shows a substantial increase on the previous year, and the number of customers has materially increased. The recently imposed import duties on bolts, nuts, and screws have begun to affect favorably the company's business since the close of the accounts, and the turnover is now showing a satisfactory progressive increase.

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New Pressure-Oiling Process For Dies

ATTEMPTS to introduce lubricant between the wire which is being drawn and the die by applying oil to the wire before it enters the die generally fail because the high pressure existing between them tends to remove the oil by forcing it out. In a new patented method, just introduced in the United Kingdom by the British Thomson-Houston Co., two dies are used, one a sealing die which effects but little reduction in the wire diameter but which serves as an oil seal, and the other the actual drawing die, spaced apart from the first. Into the closed space so formed oil is introduced at a pressure up to 30,000 lb. per square inch. This pressure, it is claimed, counteracts the tendency of the drawing pressure to remove the oil. The invention is, of course, also applicable to the process of drawing rods.

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British Stainless Steel Test

THE test recently referred to in Wire and Wire Products of 100 stainless steel articles used on

'Round the World With the Wire Industry

board ship, including bolts, screws, and various wire products, has now been completed. The complete success of the test should do much to further widen the field of usefulness of stainless steel. The selected articles were subjected to the trials of a liner voyage to Australia and back, occupying 100 days. Not one of the articles suffered any damage from corrosion. Those used for internal purposes included coathooks, cabin fittings, and numerous small items, and there was no alteration in their polished condition. On some of the samples used for external purposes, including a tap, a bracket, and a chain, there was discoloration, but three representatives of leading steel concerns, who examined the articles, state that the whole of such discoloration is removable by rubbing, and that no corrosive damage has been done to the metal. These experts also express the opinion that if stainless steel plates were used for shipbuilding purposes they would avoid during the life of the ship the damage now caused by corrosion of mild steel or iron.

So far as inside and deck fittings are concerned, the experts are satisfied that 18 per cent chromium 8 per cent nickel steel has been proved to be in every way suitable.

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Increased Consumption of Wire Netting in Argentine

ARGENTINE is one of the very few countries which has bought more netting from Germany and Belgium in 1932 than in 1931. The total for the first half of this year was 1088 tons as compared with 787 tons in the same period in 1931, and this in spite of the exchange difficulties.

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ACCORDING to Argentine statistics, Germany supplied 518 tons this year, against 347 last, which puts her far in the lead, as the corresponding figures for the U. S. A. were 145 against 102, and for Belgium 214 against 157, the balance being from England, Austria and Holland. It is safe to say that the bulk of Holland's contribution was German netting re-sold.

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ALTHOUGH the Government plans for fighting the locust plague by the use of fencing has not been carried through, many individual farmers of the northern provinces have put up barriers of netting, and their success has led to orders from their neighbors. This business is of course chiefly in rather fine mesh, but business in coarser mesh is improving, especially in the Buenos Aires district.

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PROSPECTS for the second half of 1932 were good. The Government arranges the financing if it can be shown that the purchase is an actual necessity, especially if it relates to the battle against the locust plague.

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IN the first four months of 1932 Mexico imported 1844 tons of barb wire, about one-fifth of which was German. The United States supplied a little over a half, and Belgium about a quarter. This is a 25% increase over imports for the corresponding months of 1931.

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THE demand for barb fence is due for a decided increase, as seven states have undertaken a 3 year program of putting extensive areas of grazing land under fence. Large tonnages of barb wire will be required, and the Mexican wire industry is not equipped to handle this business. This will work out nicely for Germany, although there will be serious problems in the matter of financing. Most of the requirements will call for a wire of rather lighter gauge than usual.

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German Fourdrinier Wire in America

THE American paper and carton manufacturers import considerable quantities of fourdrinier wires. The German wire industry, which in the past has played a minor role in this business, has lately strengthened its position very considerably. In the first half of 1932 the United States imported 711,400 square feet of mesh of which 68% was from Germany as compared with 37% in the previous year and 22% in 1930. The French and Austrian shares fell off considerably, and Belgium and Czechoslovakia, who were once strongly entrenched in this field, have fallen out of the running.

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German Barb-Wire Exports to U. S. Increase

IT is interesting to note the rapidly strengthening position of the German wire industry in the export of barb-wire to the United States. In the first 8 months of 1932 the United States imported 18,487 tons of this commodity, as compared with 12,976 tons in the corresponding period of 1931 and 5978 tons in 1930. Of the 1930 business, Germany secured almost exactly 50%; of the 1931, 71%; in the first quarter of 1932 82.6%, second quarter 88.2%; in July 97.8% and in August 98.1%. The German wire industry, whose barb wire ranks high in America for its superior quality, now appears to completely dominate the market. In other wire products imported by the United States, Germany's share is from 30 to 50%, except in plain round wire, of which her share is only 22%.

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The Balkan Countries Wire Production

THE Balkan countries all have wire industries of their own, even though none of these industries is sufficient for the needs of its own country. The depression has been particularly heavy in the

'Round the World With the Wire Industry

Balkan states and has robbed them of nearly all liquid assets. In consequence their production has declined, not only through lack of business but because of the fact that for some years past there has been practically no new money put into the plants, whose efficiency has suffered in consequence. Many plants especially in Yugoslavia and Greece are using machinery that is obsolete.

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THE wire production of the various Balkan states for the first half of 1932 compared with production in the corresponding period of 1931, is, in tons, as follows:—Wire Nails—Bulgaria, 456 (624); Yugoslavia, 788 (1133); Greece, 1108 (2088); Roumania, 1968 (2836). Wire Rope—Bulgaria, none; Yugoslavia, 218 (344); Greece, 88 (77); Roumania, 465 (498). Round and Barbed Wire—Bulgaria, 326 (555); Yugoslavia, 1207 (1737); Greece, 1208 (1722); Roumania, 1788 (2280).

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UNDER the heading "wire nails" is included tacks, both wire and cut. As will be clear, the production has dropped considerably, and this in spite of the fact that stocks are at a very low level. It is doubtful whether the decline can be checked in the second half year.

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Wire Industry of Australia

PROTECTED by high tariffs the wire industry of Australia has grown rapidly and is now capable of supplying practically all the requirements of the country, though naturally at rather high prices. The total output in 1931 was 37,860 tons divided as follows:—

Nails—11,588 tons
Barb wire—10,967 tons
Fence wire—12,688 tons
Netting wire—2,245 tons

The balance was made up of rope, screen cloth and miscellaneous items.

THIS tonnage did not completely cover the needs of the Commonwealth and 9200 tons were imported, of which England supplied 78%, Canada 18% and Europe the balance. The Canadians are especially active in searching for a foothold in this market.

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THE Australian prices are extremely high, and since the general increases early in 1932 have run 100% over the German domestic and 200% over the IWECO export prices. High tariff and high freight give the industry a powerful protection which has been increased by the depreciation of the Australian pound.

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THE Australian wire products are of good quality, the only serious complaint being that of the South Australian buyers of nails for fruit crates that the nails are too soft. Altogether there are seven wire mills in Australia, of which one makes woven wire products only, two only wire nails while the rest handle all the common products. Production and efficiency average high.

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RODS are imported only for special work, chiefly from England but recently to some extent from Canada. Some brokers have recently tried to import nail wire for the local nail mills and with some success.

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RECENTLY an effort has been made to develop an export trade. Small shipments have been made to the South Pacific markets, but high costs make the success of this enterprise very doubtful.

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Review of the British Netting and Screen Cloth Industry

THE British wire weaving industry is not equipped to play so large a part in the export markets as the German industry, because the so-called "THURINGER" grade, (deadsoft) is made, if at all, in very small amounts and the American type (full hard) is produced by only one company. Warrington is the center of the industry (Greening & Co. and others). The British trade has occupied itself more and more with special fabrics for industrial uses, notably for mining, both metal and coal, the cement industry, gold recovery etc., and has attained a strong position in this field, particularly in the very fine weaves.

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THE cement plants of America and other foreign countries take very considerable tonnages of fine mesh from England, and so far Germany has been unable to get a foothold in this line.

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THE cement plants of India, for example, those of South China 100%, to say nothing of the business in the Dominion, so far as it is not covered by the Dominion's own plants, South America and Southern Europe buy their wire fabric for cement production from England. This business is of course, in the very fine meshes, practically watertight, woven of 47 and 48 gauge copper in 180 to 200 mesh.

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IN the finer grades of brass mesh also the British manufacturers are strongly intrenched, especially in the gold mining industries of Canada and South Africa. The British are also well established in the coarser fabrics, classed as "wire screen".

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THE number of plants making all grades is four: There are three making coarse grades only, and four specializing in the very fine. The British industry is considerably smaller as a whole than that of Germany, although individually, the British companies are considerably larger than the German.

(*Please turn to page 56*)

A Review of Recent Wire Patents

No. 1,890,162, IRONING MACHINE FOR COILS, Patented December, 6 1932, by Clifford T. Raule of Brookline, Pennsylvania.

A purpose of this invention is to iron wound coils or the like between a movable iron and a mold turning with a hollow rotor. The coils referred to are insulated windings of rotor and stator coils and the like.

✦ ✦ ✦

No. 1,890,253, WEATHERPROOF WIRE AND METHOD AND MEANS OF MAKING SAME, Patented December 6, 1932 by Otto A. Frederickson of Ben Avon, Pennsylvania, assignor to National Electric Products Corporation of New York, N. Y., a Corporation of Delaware.

One of the objects of the invention is to provide a wire of such character that the impregnating material employed may be retained in the wire irrespective of changing temperature conditions. The construction includes a central wire conductor with a layer of asphaltic material thereon, a wrapping of fibrous material comprising compacted crinkled paper, a layer of asphaltic material over the paper and another sheet of crinkle paper with asphaltic paper compound thereover.

✦ ✦ ✦

No. 1,890,254, WEATHERPROOF WIRE, Patented December 6, 1932 by Otto A. Frederickson of Ben Avon, Pennsylvania, assignor to National Electric Products Corporation, of New York, N. Y., a Corporation of Delaware.

In this invention, for the purpose of providing a weatherproofing for an insulated wire, the inventor provides a central wire conductor and servings of transversely crumpled and compacted paper disposed around the wire conductor, this paper being substantially free of complete twists, the servings being impregnated with an asphaltic saturant.

✦ ✦ ✦

No. 1,890,224, CHAIN LINK WIRE FABRIC, Patented December 6, 1932 by Arthur A. G. Land of Chicago, Illinois.

This inventor aims to provide upright chain-link wire fabric composed of consecutively intertwisted zig-zag spiral strands, but including meshes which present at least six bights interlocked with adjacent meshes, thereby permitting wire of a given diameter and rigidity to be used effectively in fabrics presenting meshes of relatively great height in proportion to the width of the meshes and also permitting the height of the meshes to be increased greatly without altering the object-excluding effectiveness of the same.

✦ ✦ ✦

No. 1,890,008, SHUTTLE STRUCTURE FOR WIRE CLOTH LOOMS AND METHOD OF HANDLING WEFT WIRE, Patented December 6, 1932 by Herbert L. Thompson of Elgin, Illinois, assignor to Reynolds Wire Co., of Dixon, Illinois, a Corporation.

In this invention, an open coil shuttle is provided for a wire cloth loom, eliminating the ordinary bobbin generally employed, and the inventor claims the shuttle will carry fifteen times as much wire as the ordinary bobbin without becoming too heavy and that because there will be fewer changes in wire, frequent changes in the appearance of the wire cloth will be eliminated. The method covered by the patent includes drawing of the wire from the inside of a confined coil and around radially spaced annular barriers which have, with the coil of wire, a common axis.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

✦ ✦ ✦

No. 1,890,738, METHOD OF INTERLOCKING COILED SPRING, Patented December 13, 1932 by William Lewis of Utica, New York.

This invention relates to cruciform springs used in spring cushion and similar structures, the springs being adapted to be used particularly as resilient ties between the ordinary upholstering springs. An object of the invention is to enable the intersecting coil of the cruciform springs to be brought into substantially the same plane parallel with their axes so that when attached at the upper helices of the upholstering springs, the upper surfaces of the cruciform springs will lie in substantially the same plane as the corresponding ends of the upholstering springs.

✦ ✦ ✦

No. 1,891,246, NAIL, Patented December 20, 1932 by James L. Shanklin of Houston, Texas.

The nail may be of any desired shape, such as a brad, tack or ordinary nail, and the object of the invention is to provide a restricted zone on the outer end of the head which will be subject to the magnetic influence of a driving implement. It is stated that with this construction it will not be necessary for the workman to set the head of a nail against the magnetic driving head of the implement since the nail will of itself adhere to the hammer only in proper driving position.

✦ ✦ ✦

No. 1,891,258, METHOD FOR FLAME-PROOFING COMBUSTIBLE MATERIALS AND PRODUCT RESULTING THEREFROM, Patented December 20, 1932 by Ernest C. Crocker of Belmont, Massachusetts, assignor to Arthur D. Little, Incorporated, of Cambridge, Massachusetts, a Corporation of Massachusetts.

Primarily, the object of the invention is to provide flame-proof electrically insulated wire with a powdered substance adapted to produce the required effect. The inventor provides a coating for the wire consisting of a paste made up of a water solution of dextrine and powdered selenium, preferably the amorphous gray allotropic foam.

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No. 1,891,788, WOVEN WIRE BELT FOR PAPER-MAKING MACHINES, Patented December 20, 1932 by Nelson W. Webb of Belleville, New Jersey, assignor to Eastwood Wire Corporation, of Belleville, New Jersey, a Corporation of New Jersey.

It is an object of this invention to provide a seam structure for woven wire belts for paper making machines in which the lacing wire may be of the same or greater diameter than the warp wire. The inventor provides at the butted end of the wire, alternate mesh openings of greater width than the mesh openings throughout the body of the wire and which are adapted to have the lacing wire readily threaded therethrough. It is further proposed to so arrange the warp wire ends as to tend to widen and smooth any prooves in the suction boxes of the paper making machines.

✦ ✦ ✦

No. 1,891,992, WIRE MESH FABRIC, Patented December 27, 1932 by Arthur A. G. Land of Chicago, Illinois.

This wire mesh fabric particularly for fence construction comprises zig-zag strands of wire disposed transversely of the fabric and intertwisted to form longitudinal rows of mesh, which mesh are alternately triangular and deltoid-shaped, while certain of the mesh-sides have a bent portion bowed toward one of the other sides of the mesh, by which construction the effective mesh openings of the mesh are reduced, and into which the bent portions extend.

✦ ✦ ✦

No. 1,892,279, COMMUNICATION CABLE, Patented December 27, 1932 by Archie R. Kemp of Westwood, New Jersey, assignor to Bell Telephone Laboratories, incorporated, of New York, N. Y., a Corporation of New York.

In this cable construction, the wire conductor is surrounded by a magnetic loading tape which, in turn, is surrounded and underlaid with pressure equalizing material which is composed of polymerized cyclic terpene, hydrocarbon mixed with a gum of the composition $(C_5H_8)_n$. The outer layers of insulation having also between them a thin cementing layer which consists of the same hydro-carbon and gum.

✦ ✦ ✦

No. 1,892,501, MACHINE FOR PRODUCING COIL WIRE STRUCTURES, Patented December 27, 1932 by Gorman C. Burd and Otto Bratz of Adrian, Michigan, assignors to American Cable Company, Inc., a Corporation of Delaware.

Particularly, the invention covers helical wire springs, flexible shafting, and the like, and its primary object is the provision of a machine for use in forming such coils by the deformation of wire stock into helical form, a particular object of the invention being the provision of dies of a construction and capable of a method of operation such as to distribute the wear upon them more uniformly than is characteristic of conventional means for the same purpose as well as the provision of dies which are capable of carrying off and radiating the heat generated by the coiling operation. A pair of rotatable dies having the form of discs are provided, having curved peripheral dies surfaces, which, when mounted are complemental to each other forming a die of circular cross section.

Exports and Imports of Wire

Exports of iron and steel wire products in October and November, 1932
(In gross tons)

	November 1932	October 1932	November 1931
Wire rods	472	1,123	1,353
Hoops, bands, and strip steel	1,276	1,161	1,275
Plain Black or galvanized iron or steel wire	404	571	1,241
Barbed wire and woven wire fencing	904	1,500	1,051
Woven wire screen cloth	51	53	49
Wire rope	107	198	74
Insulated iron or steel wire and cable	2	5	4
Other wire and manufactures	167	109	267
Wire nails	711	365	618
Tacks	30	20	31
Other nails, including staples	219	176	183
Bolts, machine screws, nuts, rivets and washers	206	199	261
Total, these 12 classifications	4,549	5,480	6,407

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement bars	1,474	1,669	1,597
Hollow bars and drill steel	103	34	31
Merchant steel bars	3,150	2,114	2,950
Wire rods	935	403	624
Barbed wire	1,876	949	2,072
Round iron and steel wire	102	150	202
Telephone and telegraph wire	2		1
Flat wire and strip steel	131	77	39
Wire rope and strand	1448	175	152
Other wire	243	109	23
Hoops and bands	2,741	2,904	4,374
Nails, tacks and staples	1,199	862	369
Bolts, nuts and rivets	33	41	92
Total, these 13 classifications	12,137	9,487	12,526

BOTH imports and exports of iron and steel products into and from the United States gained in volume in November as compared in the October trade, to reach the highest level since May.

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EXPORTS aggregated 56,041 tons in the late month, a gain of 14,815 tons over October, with the increase more than being accounted for by an augmented scrap trade. Exports over the first eleven months of the year have totaled 540,573 tons, or 59.4 per cent of the volume of a like period of 1931, while production at 12,251,109 tons amounted to 51.3 of the 1931 figure.

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IMPORTS increased by 1,231 tons to total 34,924 tons in November. The 11-month trade of 348,892 tons represents 88.3 per cent of the 1931 11-months' volume.

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CANADA, with purchases totaling 26,333 tons in November, almost doubled her October trade with the United States of 13,720 tons, and likewise took nearly double the volume of the second most important market, Japan—13,263 tons. Its scrap purchases of 12,372 tons made up practically her entire takings. The Philippine Islands with a trade of 2,825 tons comprise the third market, with China, 2,408 tons (tin-plate 1,690 tons), Mexico 1,618, Venezuela 1,359 tons, and Cuba 1,083 tons, following.

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A DROP of 8,510 tons in receipts of pig iron, accounted for by declining shipments from the Netherlands, failed to offset small gains in 20 of the 34 classes into which the trade is divided. The most important of these gains occurred in receipts of structural shapes, 3,180 tons, while notable increases also took place in the trade in ferromanganese and spiegeleisen, 2,027 tons, sheets, skelp and sawplate, 1,380 tons, and in merchant steel bars, 1,036 tons.

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AMONG the outstanding items imported by Belgium from the United States were merchant steel bars amounting to 2,087 tons.

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GERMANY nearly doubled her tonnage shipped to this country, with barbed wire, 1,726 tons, and nails, tacks and staples 1,054 tons as outstanding items. France's total included 1,000 tons of hoops and bands.

✦ ✦ ✦

RECEIPTS of card clothing more than doubled to total 11,727 square feet valued at $10,432 with 10,435 feet valued at $8,678 coming from the United Kingdom and 1,292 square feet valued at $1,754 from Germany.

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WIRE cloth and screening receipts—23,679 square feet likewise more than doubled, with 10,181 square feet coming from France, 7,801 square feet from Germany and 5,697 square feet from Canada.

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FOURDRINIER wire receipts dropped slightly to 66,049 square feet with 32,736 square feet coming from Germany, 14,578 square feet from Austria, 12,420 square feet from France, 4,794 square feet from Sweden and 1,521 square feet from Czechoslovakia.

✦ ✦ ✦

IMPORTS of wire fencing and netting were again smaller—receipts of that galvanized before weaving totaling 797,184 square feet (666,684 square feet from Germany and 130,500 square feet from Belgium), while the trade in that galvanized after weaving amounted to 1,040,370 square feet (889,620 square feet from Germany, 102,600 square feet from Belgium and 48,150 square feet from the Netherlands.

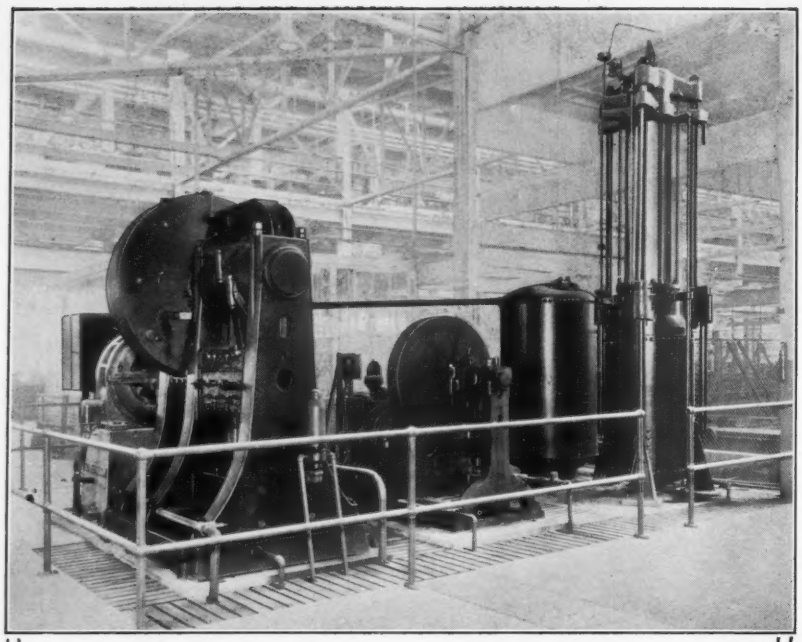
✦ ✦ ✦

WIRE heddle receipts fell to 1,546,000 pieces—1,396,000 from France and 150,000 from Belgium.

✦ ✦ ✦

One Strand Barbed Wire In African Market

IN the December issue of WIRE AND WIRE PRODUCTS mention was made of the poor market on the one strand barbed wire Overseas. This, however, must now be rectified as actually this wire is now quickly gaining ground in South Africa, where it had been offered in vain during many years. The government there has placed a fair order which in turn is stimulating private buyers to buy this material. This was a sudden change which the manufacturers hope will continue.



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'Round the World With the Wire Industry

(*Continued from page 53*)

GERMANY'S total exports for the year 1931, judged by the results of the first 11 months was approximately 238,500 tons of wire and wire products, a decline of 26% in quantity and 39% in value as compared with the 1931 export figures.

✦ ✦ ✦

WIRE netting and wire mesh maintained their standard, even gaining slightly over 1931, but the decline in all other wire manufactures was rather serious.

✦ ✦ ✦

IN the medium sizes, such as fly-screen, the British plants play an entirely subordinate role. Although these grades constitute the bulk of the tonnage, the British makers have been unable to establish any hold on the market. Since going off the gold standard they have made further efforts but so far as is known, no considerable amount of business has been booked in these grades. In phosphor-bronze and in tinned steel, in weaves other than square, England has booked a fair tonnage. She has also got a good foothold in woven-wire conveyor bults for industrial purposes, a field which Germany should be able to dominate.

✦ ✦ ✦

AS for the British export prices, the legend that England is selling at uncommonly low prices has no foundation in truth. The exact opposite is true. British prices are higher than ever, and in consequence there is a certain amount of importation. Recent British quotations on fly-screen—2x50 ft. no. 23/v have run seven shillings, sixpence, at which figure naturally, no business was done. but the plants refuse to sell under that price. The prices for the finer weaves, however, are fairly reasonable.

✦ ✦ ✦

THE British plants are cooperating on a plan to have all their netting uniformly marked as "British Made".

ITALIAN brass wire makers have established branch offices in Calcutta, Indian and Shanghai, China, where they are now competing. The Italian brass wire trade is rapidly growing in importance.

✦ ✦ ✦

THE situation on the wire rod market is rather satisfactory at present. The German production which was only 42,000 tons monthly average for the first half of 1932 has now been advanced to 57,000 tons in October and 62,000 tons in November and probably more than 66,000 tons in December exceeding the output of the last quarter of 1931. The improvement is due to a better demand on the domestic markets and more export business. Although the British market buys nothing, Japan, the Latin American markets, British India, Palestine, South Africa and Spain are taking much more than last year and will probably continue to buy more.

✦ ✦ ✦

THE Fourdrinier wire manufacturers of Austria, France and Germany have signed a preliminary agreement, which provides for the fixation of prices for export to a number of markets, among which is the United States. However, if Sweden Czechoslovakia, Holland and Belgium do not enter into this agreement, the success of it is not very promising.

✦ ✦ ✦

THE position of the IWECO members is still being dangerously threatened by the Japanese wire nail competition, although the Japanese wire nail manufacturers are unable, at present to accept any more orders, as they are sold out for at least 3 months. The IWECO has not yet reduced prices as was anticipated, but is starting a very keen propaganda campaign, particularly by giving customers the information, that Japanese wire nails are heavier, approximately 1000 Japanese nails weighing the same as 1060 to 1075 German-Belgian nails (of course of the same dimension), so that it is only advantageous to buy Japanese nails if they are more than 7:5% cheaper than European nails. (Japanese nails mostly have larger heads and too much scrap is mixed between the nails.

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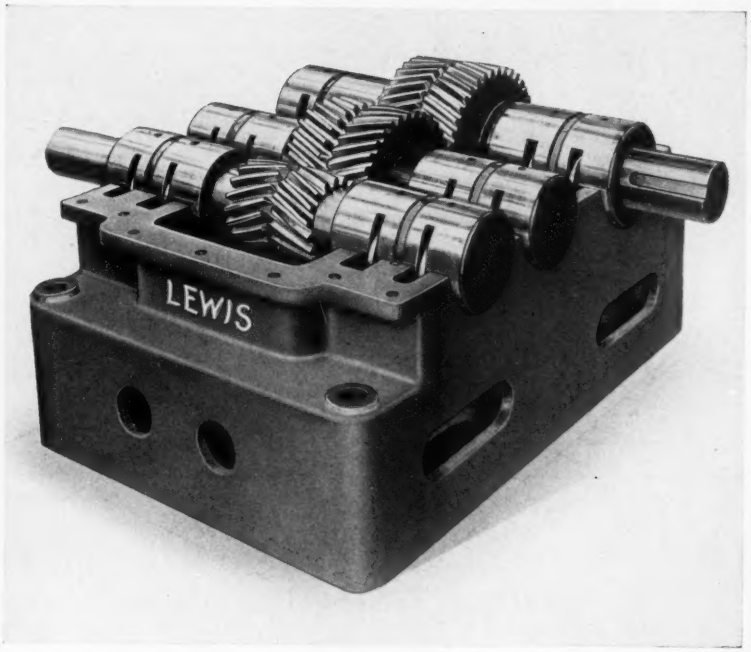
FOR CONTINUOUS ROD MILL



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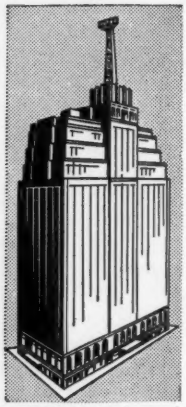

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UNDER NEW MANAGEMENT "A RELIANCE HOTEL"

Industry in War

(*Continued from page 50*)

war. Extensive and exhaustive studies should be prosecuted, with the end in view of developing possible substitutes, especially as regards the use of strategic raw materials.

(5) Provision must be made for the legal aspects of any super-agencies to be established in time of war for the purpose of coordinating the various agencies involved in the maximum effort.

(6) Provisions must also be made for the removal, upon the outbreak of war, of peace time legal restrictions upon the defensive procuring agencies.

(7) That in order to avoid the congestion associated with certain districts in the last war, the functions of procurement should be decentralized, while retaining centralized control only.

(8) That the unsolved problems of the last war should be constantly studied, and their solution vigorously prosecuted.

(9) We must realize that the problems of the last war may not be those of the next: consequently, intensive study should be directed toward the anticipation and solution of new issues, with emphasis laid on the principle of flexibility.

(10) That in all planning, we should constantly bear in mind that expression of Napoleon's which seemed to be his guiding star: "Time is everything."

+ + +

IN order to apply these principles in current planning, there has been established, under the Assistant Secretary of War, a Planning Branch, which not only directs and coordinates the planning work of the various arms and services of the army, but carries on extensive study, research, and investigation within its own department on such subjects as strategic raw materials, contributory requirements (power, labor, transportation, raw materials, semi-finished or finished components, etc.) and other allied topics. How this is done in investigating the use of substitutes, for instance, for a single item like manganese, would make an interesting story, and may well be made the basis of future articles of this nature.

Thomson-Judd Wire Machinery Company Organization Announced

The Wire Machinery Department, organized last fall by the Thomson-Gibb Electric Welding Company, with factories at Lynn, Mass. and Bay City, Mich., has been incorporated under the name Thomson-Judd Wire Machinery Company. This new company is a subsidiary of the Thomson-Gibb Electric Welding Company and will be located at Lynn, Mass.

The Thomson-Judd Company will manufacture a complete line of wire drawing machinery for both steel and copper wire; high speed, planetary and rigid type stranders for wire rope and electric cables; high speed textile and paper insulating machinery; armoring and saturating machinery; galvanizing, annealing and tinning equipment; wire welders and brazing machines.

The officers of the Thomson-Judd Wire Machinery Company are: George A. Cutter, President; Josiah Judd, Vice-President and General Manager; Daniel J. Lyne, Secretary, and A. P. Reed, Treasurer. The directors are George A. Cutter, Josiah Judd, W. H. Gibb, A. P. Reed, A. R. Petterson and W. T. Ober.

INFORMATION SERVICE

Improvements in processes and methods of production for rod, wire, strip and insulated wire and cable are being constantly made.

Manufacturers of materials, tools and equipment also are making additions and improvements to their lines.

Technical processes of production are being developed consistently.

To members of the Wire Association an information service is available by which they can obtain data on any subject relating to the industry on which they desire information.

WHY DON'T YOU JOIN THE WIRE ASSOCIATION:

ADDRESS THE SECRETARY

Richard E. Brown, 17 East 42nd St., New York, N. Y.

What Is Toncan Wire?

FOR many years we have been accustomed to think of galvanizing as the best and cheapest method of protecting wire and wire goods from rust. Zinc is not an expensive metal, and coatings of that metal are cheaper than the majority of coverings. Hence galvanized wire, wire goods, netting and wire cloth are considerably more in evidence than the same materials coated with chromium, lead, cadmium, nickel or lacquer, and it is very doubtful whether any of these will ever displace zinc.

✦ ✦ ✦

IT seems probable that the rivalry which galvanizing has most to fear is that of the corrosion resistant alloys. Zinc is not an ideal protection of the base metal, for the best galvanized jobs will rust after prolonged exposure. What is more likely than that an intensive effort will be made to make the base metal itself rust-proof? A visible evidence of this trend is afforded by the excellent results which attend the use of wires fabricated from the Krupp group of stainless steels, which are finding uses throughout the world, and which are as yet nearly without a rival.

✦ ✦ ✦

IT is not only in Germany however that metallurgy is seeking an answer to this problem; in America, the greatest steel producing country of the world, thousands of dollars are being poured out in research and technical development of alloys which resist in various degrees the attack of rust. As a result there is already appearing here and there in the markets of Europe, Toncan metal, especially in the finished forms of wire, barbed fence, screw and rivets. According to the producers of Toncan metal, the telegraph companies of various countries are showing a keen interest in its possibilities, and only recently announcement was made in the press that the Government of New Zealand was considering this material for telephone lines.

*Translated from Draht-Welt, Halle-Salle, Germany, by Kenneth B. Lewis.

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FOR WIRE DRAWING

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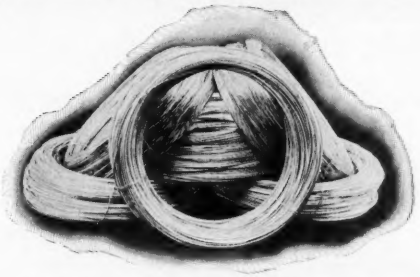

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LEAD ANNEALED	TINNED	ROPE WIRE
MUFFLE ANNEALED	COPPERED	TELEPHONE WIRE

✦ ✦ ✦

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✦ ✦ ✦

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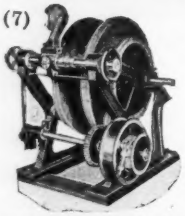

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What Is Toncan Metal?

THE name itself was derived in the simplest fashion, by reversing the syllables of Canton, the name of the Ohio city where the metal had its origin. Originally the name denoted an unusually pure ingot iron, whose resistance to corrosion arose solely from its purity. It was then applied to a copper bearing ingot iron of somewhat better properties, to which there was soon added a certain percentage of Molybdenum which further accentuated its desirable properties. This iron-copper-molybdenum alloy, which has a particularly strong appeal to our own branch of the steel trade, is now well established under the name "Toncan".

✦ ✦ ✦

MOLYBDENUM is of course reduced from its ore, being refined by special processes to a grayish metal or to a black graphite-like powder. Added to the copper-iron alloy it increases in a measurable degree the well known resistance of that alloy to atmospheric corrosion. It is well known that the addition of molybdenum to steels alloyed with nickel, chromium, or Vanadium is advantageous, and it is also a fact metallic molybdenum resists in a high degree the attack of the mineral acids, and has the effect of carrying this property into its alloys.

✦ ✦ ✦

MOLYBDENUM additions have two distinct functions in connection with iron-copper alloys. In the first place molybdenum counteracts a tendency of copper to unite with the metalloid impurities and impede their diffusion through the mass. In this way molybdenum affords a better control of the structure and assures a closer approach to that perfect homogeneity which is of such value in a rust-proof alloy. Its second function is of particular value in material which is to be cold-worked. Cold working is a severe test of metals in many ways, and often has a strong tendency to reduce its resistance to corrosion. As its users know,

however, Toncan metal has the same degree of corrosion-resistance after cold work as before. This must be ascribed to the influence of Molybdenum, and accounts for the constantly growing interest shown in America in this iron-copper-molybdenum alloy.

✦ ✦ ✦

IT is clear that a steel wire alloyed with copper and molybdenum cannot be cheap. We know well that a steel carrying only half the amount of copper, (.20 to .25) is inferior to galvanized steel, and that a larger percentage of copper bears heavily on the cost. Since Toncan metal never carries less than .40 copper, it is obvious that Toncan wire can find markets only where cost is of secondary importance.

✦ ✦ ✦

BESIDES copper to the amount of .40 to .42 per cent, Toncan metal carries the following elements: Carbon .02; Manganese .14, Sulphur. 035, Phosphorus .005, Silicon .005 and Molybdenum about .70. The metal is a rust-resisting very pure basic open-hearth ingot-iron in which copper and Molybdenum are so well diffused that the result is a uniform homogeneous and fine-grained metal. The properties are as follows:

Specific gravity—7.88
Electric conductivity—12½% referred to copper
Heat conductivity — about the same as steel
Coefficient of expansion—.00000674
Melting point—1524 Centigrade.

✦ ✦ ✦

IN the course of twenty years work American metallurgists have built up this alloy into a new and useful product which unites to the advantage of rust-resistance those of good malleability and high ductility. Toncan metal can be welded by all the current processes, electrical or autogenous, and ca nbe shaped either hot or cold for every and any product for which ordinary steel or iron is suitable. Brazing and riveting present no new problems; galvanizing and sherradizing can be

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done upon a Toncan base exactly as on common steel. Toncan yields to cold working processes distinctly easier than do many grades of ordinary steel. It can be hot-worked by forging, rolling or drop forging.

✦ ✦ ✦

TONCAN metal requires rather more than ordinary care in annealing. A process anneal to remove the effects of cold work and restore dutility should always be done between 1150 and 1200 fahr. A final anneal at about 1650 fahr. followed by air cooling results in the development of a fine grain and excellent properties. Toncan metal has so little carbon that under no condition can it be hardened.

✦ ✦ ✦

IN conclusion we list the principal uses of Toncan metal. As stated, it can be applied to practically every purpose for which soft steel is suitable. The single exception is castings, a form in which it is at present unavailable. The metal is obtainable in the form of billets, bars, plates, pipes, sheets, wire, welded or seamless tubes, barb fence, screws, bolts, nuts, etc. Although in all these forms the Toncan metal is more costly than common steel, it is entirely possible that in the near future continued research will break down the price barrier.

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Sleeper & Hartley, Inc., Worcester, Mass.
Thompson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thompson-Judd Wire Mach'y Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

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Name .....

Address .....

Nature of Business .....

BUYERS' GUIDE, Continued

MACHINERY—Copper Wire Drawing and Rolling
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Measuring Wire & Cable
Lyon Measuring Machine Division of Barbour Welt'ng Co., Montello, Mass.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
H. L. Reusch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rubber Strip Covering
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila Pa.
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
F. B. Shuster Co., New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thompson-Judd Wire Mach'y Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS—See Machinery—Rolling Mill

ROLLS—
Lewis F'dry & Machine Co., Pittsburgh, Pa.

SOAPS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

STEEL PLATE CONSTRUCTION—
National Wrought Iron Annealing Box Co., Washington, Pa.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel Plate
National Wrought Iron Annealing Box Co., Washington, Pa.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Enameled For Coils
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Steel—Also Coppered Steel—Also Glavanized Steel
Keystone Steel & Wire Co., Peoria, Ill.

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THE WATSON MACHINE COMPANY

ESTABLISHED 1845

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Electric Cable and Wire Rope Machinery :

STRANDERS	Planetary & Rigid Frame types (*horizontal and vertical.*) High-Speed Tubular and Built-up types.
BUNCHERS	High-speed types for spools up to 1500 lb. capacity.
ARMORING MACHINES	For Wire (*planetary type*) and for Tape.
PAIRING & TRIPLING MACHINES	For Bare & Insulated Wire.
CLOSERS	For Wire in Planetary, High-speed & Angular types.
CLOSERS & CABLERS	For electric cable in Planetary and Angular types.
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TAPING HEADS	For applying steel tape in Eccentric and Concentric high-speed types.
JUTE & BURLAP	Applying Heads.
THREAD SERVERS	For Cotton, Asbestos, etc. application on hose and wire.
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MEASURING MACHINES	For Length Measurement.
ELECTRIC PATCH VULCANIZERS	
SATURATING, WAXING & GREASING TANKS	Gas fired and Electrical.
WIRE TINNING MACHINES	Gas fired and Electrical.
CABLE PEELERS	For removing lead sheathing and insulation.
POLISHING HEADS	Separately or Motor driven.
REEL CRUTCHES	For turning heavy reels in handling and shipment.
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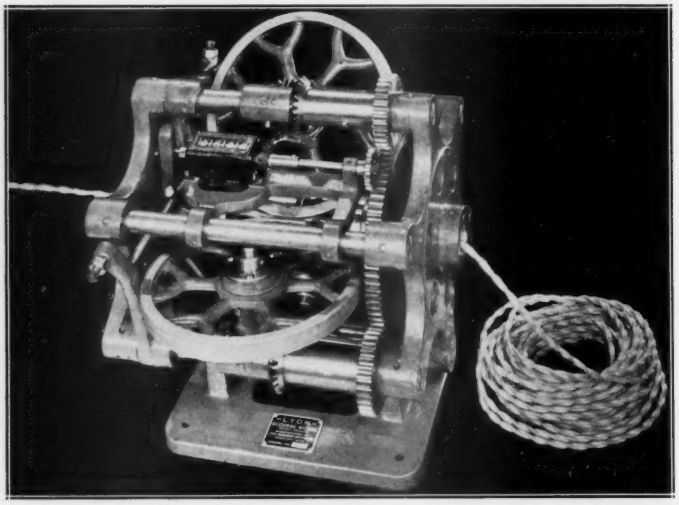
ELECTRICAL WIRE AND CABLE—WIRE ROPE AND CORDAGE MACHINERY

THE LYON MEASURING MACHINE

[Patent Pending]

Your attention is invited to an absolutely new development in measuring machinery.

The Lyon Measuring Machine is offered as a means of providing **accurate measurement of wire.**



Equipped with Veeder Root Counter of Set Type. Lock Counter as well as Trip can be Easily Attached as an extra

Features of the Lyon Measuring Machine:

(1) **Accurate measurement of all kinds of wire and cord, bare, insulated, armored, B-X cable, twisted-pair, oval, angular and odd shapes.**

(2) **No adjustment necessary for changes in size or shape of material being measured. The machine automatically takes care of such changes.**

(3) **Will not flatten softest insulation or mar trade marks or special markings.**

(4) **This machine eliminates material waste, making it possible for you to provide mechanically exact yardage.**

(5) **Simple and sturdy in construction and operation, and yet a precision machine in accuracy.**

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